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## WELDING, CUTTING, BRAZING & HOT WORK GUIDELINES

**Program: Welding, Cutting, Brazing & Hot Work Guidelines**

**Facility: Waimanalo Gulch Sanitary Landfill**

**Facility Location: 92-460 Farrington Highway, Kapolei, HI 96707**

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### PURPOSE

Describe the requirements when welding, burning, brazing, cutting or performing other "hot" work.

### REQUIREMENTS

1. Only trained authorized personnel may weld at WGS� or use Waste Management equipment.
2. Designate areas for welding, brazing, and cutting.
3. Use general or local exhaust ventilation to keep the concentration of toxic fumes, gases, or dusts below the OSHA Permissible Exposure Limits. Refer to the Industrial Hygiene database for information about exposures to welders.
4. Provide, and require the use of, flameproof screens or shields around designated welding or burning areas or move all combustible materials at least 35 feet from the welding/burning area or cover the materials with welding blankets.
5. Provide, and require the use of, personal protective equipment (PPE) as specified in the PPE hazard assessment.
6. Protect welding cables and cylinders from damage.
7. Use only approved cutting and welding equipment.
8. Use a check valve for each of the acetylene and oxygen cylinders and use a flashback arrestor at the acetylene or gas regulator.

### COMPRESSED GASES

1. Oxygen, fuel gas and acetylene cylinders must be shut off when not in use.
2. Pressure should not remain in the hoses when not in use.
3. Store cylinders upright and away from flame and heat sources.
4. Maintain labels on cylinders.
5. Separate oxygen from acetylene or fuel gases in storage by 20 feet or a 1/2-hour fire-rated non-combustible barrier 5 feet in height.
6. Segregate empty and full containers in storage.



### HOT WORK PERMITS

1. Hot Work means working with materials or equipment or in conditions which could result in fire or explosion.
2. Hot work permits must be used when welding, brazing, or cutting outside of designated areas.
3. Train and authorize an individual to issue hot work permits.
4. Use a fire watch when welding, burning or brazing outside of the designated welding area. The fire watch should man the fire extinguisher when hot work is in progress.
5. Use the hot work permit and require forced air ventilation for any welding, cutting, or brazing works inside confined spaces.
6. Hot work permits should be kept on file for one year.

### INTRODUCTION

The Waste Management written Welding Brazing/ Cutting/Compressed Gas and "Hot Work" guidelines include the following:

- Safety Procedures for arc welding
- Safety Procedures for gas welding and cutting
- Using compressed gas cylinders
- Fire prevention and protection
- Hot work control program
- Maintenance of welding equipment
- Welding in confined spaces
- Ventilation during welding
- Personal protective equipment (PPE)
- Respiratory and hearing protection
- Training

The following sections describe how WGS� addresses each of these topics.

### HEALTH EFFECTS ASSOCIATED WITH WELDING

Welding produces different fumes and dusts depending on the metal being welded, the kind of welding, and the electrode coatings on the metal.

Welding also produces gases. Gases such as nitrogen oxide, nitrogen dioxide, and ozone may irritate the respiratory tract and mucous membranes. Chronic exposure can lead to respiratory disease. Carbon monoxide may cause headaches and dizziness and at high level leads to oxygen deprivation. Argon, carbon dioxide, helium, and nitrogen deplete the atmosphere of oxygen. Arc welding can generate these gases as well.



## **WELDING, CUTTING, BRAZING & HOT WORK GUIDELINES**

Welding produces intense light and heat. Electric welding can cause electric shock and burns. The intensely bright light produced by welding can burn the eyes and skin very quickly.

Fumes from welding steel products can irritate the lungs. The excessive breathing in of fumes can cause the flu-like symptoms of metal fume fever. Nickel fumes also irritate the lungs, and skin contact can produce an allergic reaction. Airborne nickel dusts can be cancer causing when breathed in. Airborne chromium dust can be toxic. However, nickel and chromium fumes are not considered cancer causing.

### **GENERAL SAFETY GUIDELINES**

Follow these guidelines when welding:

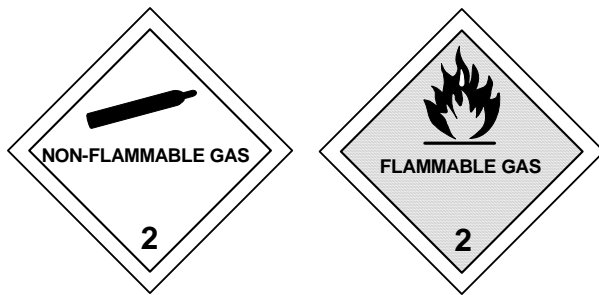
- Avoid prolonged breathing of gases, fumes, and dust.
- Never weld in damp or wet areas without protective equipment.
- Wear safety glasses, leather welding gloves, a welding helmet, and protective clothing.
- Keep the area clear of combustibles (at least 35 feet from the hot work area).
- Regularly inspect all equipment to ensure that it is in good working condition.
- Use an NIOSH-approved respirator for fumes when other controls do not bring fumes, dusts, or other contaminants down to safe levels.
- Use fire-resistant welding curtains or shields constructed of noncombustible materials positioned so that others do not see the welding arc.

### **ARC WELDING**

- Cover welding cables located on the floor or ground so they don't cause a tripping hazard.
- Don't overload cables.
- Don't use worn or poorly connected cables. Inspect the cables and connections frequently.
- Don't operate or move the polarity switch under the load of a welding current.
- Do not leave the electrode in the lead when it is not in use. Shut off the welder when not in use.
- Never weld on trucks that have the motor running. Disconnect the vehicle battery cables before welding.
- Don't operate the range switch under load.
- Follow lockout/tagout procedures when performing servicing or maintenance on machines. (Note: Repairs are to be made only by qualified persons.)
- Never leave an uninsulated electrode holder or a "live" electrode on the tabletop in contact with a grounded metallic surface.
- Ensure that welding leads are free of cracks or cuts in the insulation.

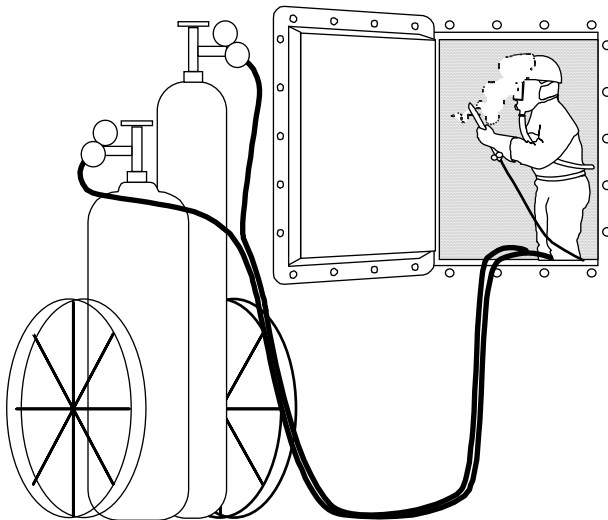
## **GAS WELDING**

- Use welding and cutting torches equipped with antiflashback valves.
- Follow the safe handling and use procedures for compressed gas cylinders detailed in these guidelines.



## **COMPRESSED GAS CYLINDERS**

The gas in cylinders like the ones used for welding is highly pressurized and can create a potentially hazardous situation. Cylinders exposed to heat, fire, or rough handling can explode with great force. For this reason, store cylinders in a cool, dry place. Chain and cap them when they are not in use. Before you use a cylinder, read the label to verify the contents. Report illegible labels to your supervisor.



## **SAFE HANDLING REQUIREMENTS**

Wear safety glasses and insulated neoprene gloves when transporting or exchanging cylinders, or when connecting or disconnecting regulators.

Use a hand truck to transport cylinders.

Check hoses for leaks. Shut off the cylinders when hoses are connected but not in use.

Check regulators when changing cylinders to be sure they are free of dust and oil.

Inspect cylinders for defects, corrosion, and dents. Isolate and mark any defective cylinders, and contact the vendor immediately for pick-up.

Store filled cylinders inside in a well-protected, well-ventilated, dry location. They must be at least 20 feet from highly combustible materials, sparks, open flames, excessive heat, and away from elevators, stairs, or gangways. Keep cylinders secured to prevent them from falling over. Separate stored oxygen cylinders from stored fuel gas cylinders or combustible material (especially oil or grease) by at least 20 feet or by a noncombustible barrier. This barrier must be at least 5 feet high and have a fire resistance rating of one-half hour.

Mark all cylinders legibly to identify their contents. If the cylinder is unmarked, do not use it.

If a cylinder is leaking, close the valve, cap, and move to a well-ventilated area. Contact the supplier immediately.

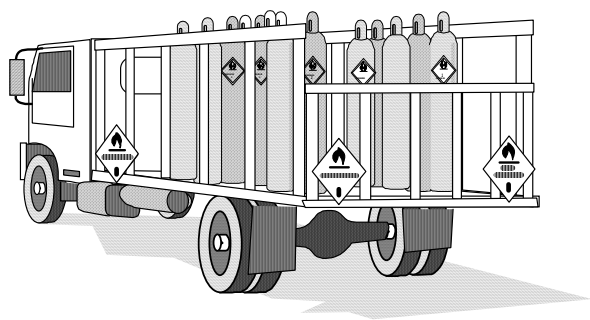
For cylinders that are flammable, use a non-sparking wrench when changing.

Be careful that cylinders are not placed so as to become part of an electrical circuit.

Never try to mix any gases in a cylinder.

Never try to refill a cylinder.

Mark empty tanks “MT,” close the valves, and replace valve caps securely. Separate “MT” and full tanks.



## **ATTACHING REGULATORS**

- Handle the regulator carefully at all times. Do not use pipe wrenches or pliers for attaching regulators to cylinders. Use an open-end wrench of the proper size instead. Use a close-fitting wrench to avoid stripping the threads. Hammers or wrenches must not be used to open or close cylinder valves that are fitted with hand wheels.
- When opening the valves, never stand in front of the regulators. The tanks are under pressure and the regulators may explode when opened.



### REQUIREMENTS FOR HOSES, TORCH VALVES, AND CONNECTIONS

- Replace or repair hoses showing leaks, burns or worn places.
- Color-code hoses to avoid accidental mixing.
- Connect hoses to regulator properly. Check hose connections for proper threading. Standard hose connections are threaded right-hand for oxygen and left-hand for acetylene or other fuel gas. This helps prevent an accidental switch of oxygen and fuel-gas hoses.
- Use only approved bronze or brass fittings. Copper fittings must never be used on acetylene cylinders. Under certain conditions, the acetylene might react with the copper to produce an explosive compound.
- Do not use oil, grease, or similar substances on any torch or regulator. Oil and grease in the presence of oxygen may burn with explosive force, if ignited.

### TESTING FOR LEAKS

To test for leaks, open the fuel and oxygen cylinder valves with the needle on the torch closed. Adjust the regulator to normal working pressures, and apply soapy water to connections and hose with a brush. If bubbles form, a leak is present. Correct condition as necessary. Do not try to repair hoses with tape. Do not use any other testing method.

### GAS WELDING AND CUTTING

#### Lighting and Shutting Off the Torch

- Ensure the proper welding or cutting tip is selected and installed.
- Purge the hoses by opening the valve on the acetylene cylinder. This should never be opened more than one and one-half turns. Three-fourths of a turn is preferable.
- Open the acetylene torch valve one-fourth turn.
- Adjust the acetylene to working pressure with the gas regulator screw.
- Close the acetylene torch valve.
- Slowly open the oxygen cylinder valve all the way.
- Open the oxygen torch valve one-half turn.
- Adjust the oxygen to working pressure with the gas regulator screw.
- Turn off the oxygen torch valve. The final steps are the actual lighting of the torch.
- Reopen the acetylene torch valve one-fourth to three-quarters turn and light the gas with a spark lighter. (NEVER USE MATCHES.)
- Increase the fuel supply until the flame has a slight tendency to jump away from the tip. Gradually open the oxygen needle.

Follow the procedures below for shutting off the torch:

- Close the torch valves acetylene first, then oxygen.
- Close the cylinder valves acetylene first, then oxygen.



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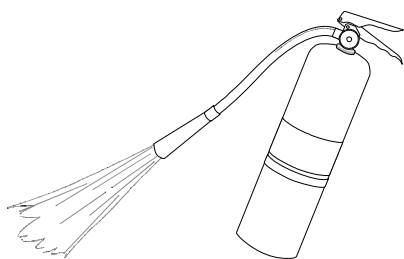
- Open both torch valves to release the pressure.
- Shut off the regulator-adjusting handle until you no longer feel any spring tension.
- Close the torch valves. This procedure reduces the possibility of regulator fires when the oxygen cylinder valve is open again. It will also prevent leaks of acetylene or oxygen while the equipment is not in use. A leak could cause a serious fire.

### FIRE PREVENTION AND PROTECTION

The site program administrator designates safe areas for welding, brazing, and cutting free of combustible and flammable materials. Welding and cutting in these areas should not pose a hazard to welders or workers in nearby areas. Work site preparation to avoid fires and/or explosions includes ensuring all combustibles are at least 35 feet from the work area. If this is not possible, protect combustibles using flameproof covers, and complete a Hot Work Permit [HOT WORK PERMIT FORM].

Follow these safe work practices when welding to prevent fires and/or explosions:

- Know the location of nearby fire extinguishers and know how to use them.
- Do not weld in locations close to chlorinated hydrocarbon vapors coming from degreasing, cleaning, or spraying operations. Heat or rays from the arc can react with solvent vapors to form a highly toxic gas and other irritating products.
- Do not weld on containers or barrels which have held combustible or flammable materials or materials which, when heated, give off toxic vapors. Perform cleaning, purging, or inerting first.
- Do not weld on a closed container unless the contents have been identified and found to be non-flammable.



### CLEANING CONTAINERS

- When you know the container held a gas or liquid which will readily dissolve in water, use the following method:
  - Flush out the container with water several times, and then fill the container with water.
  - Before welding, be sure there is a vent or opening on the container to provide for release of air pressure.

- When you know the container held a gas or liquid that will not readily dissolve in water, perform the following procedure:
  - Clean out the container thoroughly with steam or a compatible-cleansing agent. Purge all air or inert materials with a gas such as carbon dioxide or nitrogen before repairing. Carbon dioxide is heavier than air and will tend to remain in the container if the opening is at the top.
  - Use steam to clean out light material.
  - Use a strong caustic soda solution to clean out heavy oils or grease.
- Don't clean where there is poor ventilation. Ventilation is necessary to carry away harmful or explosive vapors.
- Don't clean near any open flames. When scraping or hammering to remove heavy sludge or scale use a spark resistant tool and keep the tool wet to avoid sparks.
- Keep your head and arms as far away from your work as possible.

### HOT WORK CONTROL PROGRAM

To minimize the potential for employee injury from fires/explosions arising from unsafe cutting and welding practices, and in certain conditions such as confined spaces, a hot work control program must be implemented. At a minimum, the program must include the following elements:

- Where cutting, welding or other hot work is performed on a regular basis, one or more permanent designated areas must be established for this work.
- A permit system for authorizing the temporary use of portable cutting and welding equipment outside of designated areas must be used.
  - Document precautions on **[HOT WORK PERMIT FORM]**.
  - A permit must not be issued if the work can be moved to a designated hot work area.
  - A supervisor must inspect the area to verify that all necessary precautions have been taken before filling out and signing the permit.
  - The welder must post a signed permit in the area where the hot work will be done before commencing work.
  - The welder must return the permit to the supervisor when the work has been completed, signing off on the permit to indicate that a final check-up was conducted.

### HOT WORK SAFETY RULES

- Obtain a permit before performing hot work outside of designated areas.
- Check the condition of hot work equipment prior to each use. (Note: A visual inspection should be made with special attention to electrical cables and gas hoses. A soap solution should be used to check for leaks at valves and connections of oxygen-acetylene sets, especially after changing cylinders.)



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## WELDING, CUTTING, BRAZING & HOT WORK GUIDELINES

- Protect floor and wall openings within 35 feet.
- Ensure automatic sprinklers (when installed) are functional.
- Ensure that portable fire extinguishers of the proper type are in the immediate vicinity. (Note: "A" rating for ordinary combustibles; "B" rating for flammable and combustible liquid and gases; "C" rating for energized electrical equipment.)
- Protect welding hoses against physical damage. (Note: Use UL approved welding hose reels, when appropriate.)
- Ensure a fire watch is present during hot work activities.
- Check the area 30 minutes after the work is completed for hazardous conditions or fire.

### WHEN WELDING IS PROHIBITED

You must never weld or cut in the following situations:

- If you have not been trained and authorized by management.
- If the building you are working in has sprinkler systems that are not working.
- In the presence of explosive atmospheres.
- Near large quantities of highly ignitable materials

### VENTILATION

Four main factors in arc and gas welding affect the potential for air contamination. These factors are:

- The size of the space
- The gross volume of work
- The number of welders working at one time
- The size of the welding rod

Provide adequate ventilation for protection against potentially excessive concentrations of airborne contaminants (for example, welding, fumes, and carbon monoxide gas) and oxygen deficient atmospheres.

Local exhaust may be needed when welding, cutting or brazing is done on materials which contain or are coated (treated) with fluorides, zinc, lead, copper, beryllium, cadmium, mercury, or residual chlorinated solvents (such as perchlorethylene).

Engine-driven welding equipment used indoors is to have exhaust gases piped to suitable exhaust ducts or directly outdoors. Never locate engine exhaust on or near an air conditioning intake.



### WELDING MACHINE USE

Welding machines must meet safety and design requirements. Observe the following guidelines when using arc-welding equipment:

- Be properly trained.
- Do not exceed voltage limits.
- Ground the frame or case of the welding machine.
- Ground the ground cable of every power circuit to prevent accidental shock by stray current. Do not ground to pipelines carrying gases or flammable liquids, or conduits carrying electrical conductors.
- Do not use chains, wire ropes, crane hoists, and elevators carry a welding current.
- Check ground connections.
- Provide disconnecting switches or controllers as part of the welding machines or have them near the machines.
- Do not use a welding machine to thaw out frozen water or pipes. Fire, explosion, or damage to the welding machine may result.

Follow safe maintenance practices. These practices include:

- Reporting all equipment defects or hazards to your supervisor.
- Remove defective equipment immediately from service.
- Have all repairs made by qualified personnel.
- Thoroughly dry and test machines that have become wet before using again.
- Replace cables with damaged insulation or exposed bare conductors.

### PERSONAL PROTECTION

Welders must wear the appropriate personal protective equipment. Specific requirements are detailed below.

### EYE AND FACE PROTECTION

Select the proper eye protection based on the welding operation. During arc welding or cutting operations, use a welding helmet. Helmets must have filter and cover plates designed for easy removal, and be fitted with a double lens color arc ray lens inside and clear plastic outside. Flash goggles should be used under the welding helmet, particularly while welding using a gas-shielded arc welder.

The shaded lens used in the welder's helmet must meet the test for transmission of radiant energy prescribed in ANSI Z87-1-1989. Select the correct shade of filter lens using the following chart:

## LENS FILTER SHADE GUIDELINES

Type of Operation	Shade Number
<b><u>Gas Torch</u></b>	
Light Cutting - up to one inch	3 or 4
Medium Cutting- one to six inches	4 or 5
Heavy cutting -More than six inches	5 or 6
Gas Welding - Up to 1/8" thickness	4 or 5
Gas Welding -1/8" to 1/2" thickness	5 or 6
Gas Welding- More than 1/2" thickness	6 or 8
<b><u>Arc Welding</u></b>	
Up to 30 amps	12 or 14
Shielded metal arc welding (Greater than 5/16" Electrodes)	
30 to 74 amps	10
Shielded Metal Arc Welding (Less than 5/32" Electrodes)	
75 to 200 amps	11
Gas Shielded Arc Welding (Non Ferrous)	
200 to 400 amps	12
Gas Shielded Arc Welding (Ferrous)	

Helpers or others who normally work near welding operations should also wear shaded eye protection (such as goggles). Selection of the darkness of the lens shade depends on the degree of the helper's exposure to the welding "flash." Often the helper must wear shaded goggles that are the same shade that the welder wears.

For welding, the best protection is provided by welding hoods. Welding hoods can be worn with safety hats by adding special fittings to the safety hats. For grinding, chipping, or cleaning, use protective goggles.

Inspect eye and face protection for welding before each use. Inspect helmets for cracks or defects. Replace cracked or poorly fitting filter plates. Keep a cover glass in front of the filter plate.



### PROTECTIVE CLOTHING

Supervisors must ensure that protective clothing is inspected, maintained, and worn properly to preserve its effectiveness. Additionally, employees should:

- Wear long-sleeved shirts and pants.
- Keep clothing reasonably free of oil or grease.
- Not roll-up sleeves or cuffs when welding.
- Button sleeves and collars.

### TRAINING

Welders and their Supervisors must be:

- Trained in the safe operation of their equipment and emergency procedures in the event of a fire.
- Properly trained before entering to weld in a confined space.
- Trained in health hazards associated with welding.

### DEFINITIONS

*Arc cutting:* cutting processes that melt the metals with the heat of an arc between an electrode and the base metal.

*Gas metal arc welding (MIG):* an arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal (consumable) electrode and the work. Shielding is obtained entirely from an externally supplied gas or gas mixture.

*Gas tungsten arc welding (TIG):* an arc welding process that produces coalescence of metals by heating them with an arc between a tungsten (non-consumable) electrode and the work. Shielding is obtained from a gas or gas mixture. Pressure and filler metal may or may not be used.

*Welder and welder operator:* any operator of electric or gas welding and cutting equipment.



## HOT WORK PERMIT

Date			
Time Started		Estimated Completion Time	
Department	Floor	Building	
Work to Be Done			
Permit Expires:	Date	Time	
<b>All items following have been completed. Therefore, permission is granted for this work.</b>			
Signed		Title	
<b>PRECAUTIONS</b>			
Do not cut, weld, or use other open flame or spark-producing equipment until the following precautions have been taken:			
<b>Check Each Item</b>  <input type="checkbox"/> Work Location has Been Personally Examined. <input type="checkbox"/> Sprinklers, Where Provided, are in Working Order. <input type="checkbox"/> Cutting and Welding Equipment is in Good Condition.  <input type="checkbox"/> Floors Swept Clean of Combustibles. <input type="checkbox"/> Combustible Floors Have Been Wet Down, Covered with Damp Sand, Metal or Flame Resistant Sheets.  <input type="checkbox"/> All combustibles Have Been Located Outside a Radius of 35' from the Operation.  <input type="checkbox"/> Flame Resistant Tarp Suspended from Work to Collect Sparks. <input type="checkbox"/> PPE and Flash Screens Erected as Required.		<b>Work on Enclosed Equipment</b> <b>(Tanks, Containers, Ducts, Dust Collectors, Etc.)</b> <input type="checkbox"/> Equipment Cleaned of All Combustibles. <input type="checkbox"/> Containers Purged of All Flammable Liquids. <input type="checkbox"/> Explosion Meter Used to Monitor Presence of Flammable Vapors.  <b>Work on Walls or Ceiling</b> <input type="checkbox"/> The Construction is Non-Combustible and Without Combustible Covering or Insulation. <input type="checkbox"/> Combustibles Have Been Moved Away from Opposite Side of the Wall  <b>Fire Watch</b> <input type="checkbox"/> Provided for a Least 30 Minutes After Operation is Completed or Stopped <input type="checkbox"/> Proper Fire Extinguishers or Small Hose at Site. <input type="checkbox"/> Trained in the Use of Extinguishing Equipment.	
<b>FINAL CHECK UP</b>			
Work areas and all adjacent areas to which sparks and heat might have spread (such as floors above and below and on opposite side of walls) were inspected for at least 30 minutes after the work was completed, and were found fire safe.			
Signed		Title	
<b>After Signing, Return Permit to Person Who Issued It</b>			